

# Math for All Learners: Algebra

by

Pam Meader and Judy Storer

illustrated by  
Julie Mazur

J. WESTON  
**WALCH**  
PUBLISHER

Portland, Maine

# Contents

*To the Teacher* ..... *v*

## Topic: Ratio and Proportion

- 1. Candy Promotion ..... 1
- 2. Estimating Wildlife Populations ..... 6
- 3. The Solar System ..... 12

## Topic: Patterns and Formulas

- 4. The Picture Frame Activity ..... 15

## Topic: Integers

- 5. Integer Tiles ..... 19
- 6. Subtraction with Integer Tiles ..... 25
- 7. Get It in Gear Game ..... 29

## Topic: Exponents

- 8. Powers of Ten ..... 33

## Topic: Polynomials

- 9. Distributive Property ..... 38
- 10. Discovering Algebra Tiles ..... 43
- 11. Multiplying with Algebra Tiles ..... 47
- 12. Factoring Trinomials with Algebra Tiles ..... 52
- 13. Perfect Square Trinomials ..... 59

## Topic: Linear Equations

- 14. Patterns and Slope-Intercept ..... 62
- 15. Slope as Rate ..... 69

## Topic: Graphs

- 16. Graphing Curves with a Graphing Calculator ..... 76
- 17. How Long Is the Bounce? ..... 80

## Topic: Probability

- 18. Calendar Number Probability ..... 84

## **Topic: Logarithms**

19. Discovering Log Properties .....	86
--------------------------------------	----

## **Topic: Miscellaneous**

20. Math Project: Researching Internet Providers .....	90
--	----

# To the Teacher

Since the early 1970s we have been teaching math to learners of all ages, from young children to adults, who represent many different cultures and socioeconomic backgrounds. We believe that all learners can do math by first overcoming any math anxiety and then participating in meaningful cooperative learning activities that foster the four major standards of Communication, Problem Solving, Connections, and Reasoning. These standards are founded in the Curriculum and Evaluation Standards for School Mathematics (1989), grades K–12. The draft of the content framework for *“Equipped for the Future” Standards for Adults* (1998) suggests that for adults to be “equipped for the future,” they must be able to problem-solve, make decisions, and communicate effectively using math concepts and technology in an ever-changing world.

Our goal is to encourage all learners to “know math by doing math.” To this end, we have developed activities called “labs” that enable the learner to discover mathematical concepts through a hands-on approach. Cooperative learning skills are developed through group activities in which each learner participates collaboratively as a team member. Communication skills are fostered through group discussion and written reactions to lab discoveries. Many of the labs are connected to real-life situations. Other labs require learners to form generalizations about mathematical revelations.

As teachers, we believe learning should be learner-centered, not teacher driven. The response from our learners has been favorable. As one student said, “Thank you for turning my math disability into a math ability.”

— Pam and Judy

# 10. Discovering Algebra Tiles

## Learning Outcome

Students will be able to:

- recognize the physical model for variables and constants.
- combine like terms both physically and algebraically.

## Overview

Teams will examine algebra tiles and learn to combine like terms with them.

## Time

30 minutes

## Team Size

Pairs

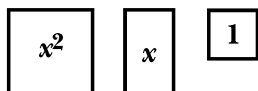
## Materials

Algebra tiles that include  $x^2$ -tiles,  $x$ -tiles, and constant tiles. Each team should have at least 5  $x^2$ -tiles, 10  $x$ -tiles, and 10 constants.

## Procedure

### Activity One

1. This activity is designed to acquaint students with algebra tiles. A variety of responses should come from the first part. Possible answers are: There are square tiles and rectangular pieces. The tiles are different colors (depends on set used; some sets have positive and negative tiles that are different colors, while other sets have the variable tiles in one color and the constants in another color). Some of the tiles seem to fit together while others do not. Please note this for students, as it will become more important when the students use the tiles to factor.
2. In the second part of Activity One, it is important to have students trace the different tiles to provide a spatial sense of each tile and to notice dimensions. For example, an  $x^2$ -tile has dimensions  $x$  by  $x$ , an  $x$ -tile has dimensions 1 by  $x$ , and a unit tile has dimensions 1 by 1.



After they have completed their tracings, assist the students in labeling the tiles.

### Activity Two

1. The purpose of this activity is for the student to see how like terms look.
2. If students put squared tiles together,  $x$ -tiles together, and unit tiles together, they probably won't then algebraically combine  $2x^2$  with  $4x$  and call it  $6x^3$ .

*(continued)*

**Answers**

1.  $| \cdot$       2.  $||$       3.  $|| \cdot$       4.  $\square$       5.  $\square \square$

6.  $\square \square \square |||| \dots$

7.  $\square \square \square \square \square = 5x^2$

8.  $\square \square \square \square \square \square ||||| = 6x^2 + 8x$

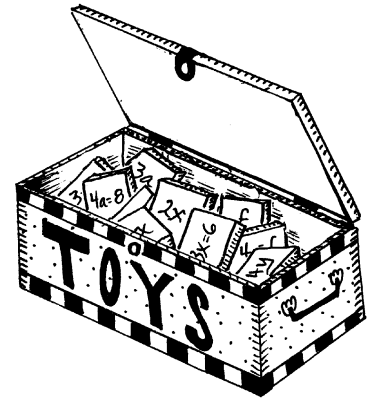
9.  $\square \square \square \square || = 4x^2 + 2x$

10.  $\square \square \square ||||| \dots = 3x^2 + 6x + 6$

# 10. Discovering Algebra Tiles

## Activity One

With your partner, dump all your tiles onto the table. In the space below, jot down all the things you notice about the algebra tiles.



Trace each kind of tile below. We will label them together.



## 10. Discovering Algebra Tiles *(continued)*

### Activity Two

With your tiles, show the following. Draw the tiles below each example. Let

$\square$  represent  $x^2$ ,  $|$  represent  $x$ , and  $\bullet$  represent units.

**Example:**  $x^2 + 3x + 2$  would look like  $\square ||| \bullet \bullet$

1.  $x + 1$

2.  $x + x$

3.  $2x + 1$

4.  $x^2$

5.  $2x^2$

6.  $3x^2 + 4x + 3$

With your tiles show the following additions. Then, for each example, group “like tiles” together and write each simplified sum below.

7.  $2x^2 + 3x^2$

8.  $2x^2 + 3x + 4x^2 + 5x$

\_\_\_\_\_

\_\_\_\_\_

9.  $4x^2 + 2x$

10.  $2x^2 + 4x + 4 + x^2 + 2x + 2$

\_\_\_\_\_

\_\_\_\_\_